



NATIONAL ACADEMY OF SCIENCES

Office of the President

May 10, 2011

The Honorable Ray Mabus
Secretary of the Navy
Washington, DC 20350-1000

Dear Secretary Mabus:

This is in reply to your letter of April 26, 2011, in which you asked the National Research Council (NRC) to comment on a letter dated October 22, 2010, from Dr. Christopher Portier of the Agency for Toxic Substances and Disease Registry (ATSDR), which addressed some aspects of a 2009 report from the NRC entitled *Contaminated Water Supplies at Camp Lejeune: Assessing Potential Health Effects*.

Thank you for providing us with a copy of Dr. Portier's letter. To the best of my knowledge, he has not discussed it directly with anyone at the NRC, nor did he send us a copy of the letter. As detailed below, the letter contains incorrect statements about the NRC's report.

The NRC's report did not conclude that persons exposed to contaminated drinking water at Camp Lejeune between the 1950s and the 1980s were unharmed. It confirmed that many people were exposed to toxic chemicals in the water supply but pointed out technical difficulties and practical limitations in conducting studies today that seek to determine with certainty whether specific health outcomes could be attributed to the exposures that occurred so long ago. The NRC report concluded that in light of these barriers to definitive evidence, it does not seem productive to invest substantial funds nor to incur further delay awaiting results of studies that are almost certain to be inconclusive. The report recommended instead that policy decisions or administrative actions be taken on the basis of what is known with certainty--that past residents of Camp Lejeune were exposed to water contaminated with toxicants that are known to be associated with adverse health effects.

Dr. Portier's letter stated that the NRC's report considered only two contaminants, trichloroethylene (TCE) and perchloroethylene (PCE), and that it failed to consider other potential contaminants, such as benzene, vinyl chloride, and mixtures of organic compounds. This is incorrect. Although the Congressional request for this NRC study specified only TCE and PCE, so the committee's report focused primarily on those toxicants, the NRC's report also identified additional chemicals of concern at Camp Lejeune and presented an appendix reviewing the toxicity of benzene and vinyl chloride, as well as five other chemicals and solvent mixtures. The reviews included the following statements:

Benzene is a well-studied chemical and has been the subject of several comprehensive reviews and risk assessments (IARC 1982, 1987; EPA 1998b, 2002; ATSDR 2007). It is well established in those reviews that benzene is associated with effects on the hematologic, immune, and nervous systems. . . . There is agreement in the scientific community that benzene is a human carcinogen (IARC 1987; EPA 1998b; NTP 2005; ATSDR 2007).

VC [vinyl chloride] has been classified as “carcinogenic to humans” by IARC (1979, 1987), a “known human carcinogen by the inhalation route of exposure” by EPA (2000), and “known to be a human carcinogen” by NTP (2005) on the basis of the findings of epidemiologic and animal studies.

Dr. Portier’s letter asserted that the NRC report’s conclusions on TCE and PCE differ from those of the National Toxicology Program (NTP) and the International Agency for Research on Cancer (IARC). His letter states: “NTP and IARC. . . classify these chemicals as ‘probable human carcinogens’ (IARC) or ‘reasonably anticipated to be a human carcinogen’ (NTP) with various cancers including most notably kidney tumors.” In fact, statements such as the following from the NRC’s report clearly indicate that several cancers are of concern:

Chapter 5 reviewed the epidemiologic studies and concluded that there was limited/suggestive evidence of an association between chronic exposure to TCE or PCE and cancers of the breast, bladder, kidneys, esophagus, and lungs. Toxicologic studies did not report significantly increased cancers of the breast, bladder, or esophagus, and rodent lung cancers were judged not to be relevant to humans because of known species differences in metabolism and organ sensitivity. Thus, for outcomes having limited/suggestive epidemiologic evidence of an association, positive concordance with the toxicologic evidence was strongest for kidney cancer. Studies of TCE and PCE found increases in kidney cancer in rats treated chronically at high doses. The mechanism by which solvents exert their effects on the kidney appears to be similar in rats and humans, and this strengthens the plausibility that these solvents caused kidney cancer in occupational studies that found suggestive evidence of associations.

Dr. Portier’s letter implied that the NRC’s report failed to consider adverse health effects other than cancer. This is incorrect; the NRC’s report addressed many non-cancer effects. In chapter 4, the NRC report discussed toxicologic evidence on hepatic (liver) toxicity, renal (kidney) toxicity, pulmonary toxicity, genotoxicity, male and female reproductive effects, developmental effects (pregnancy outcomes, growth and development), neurologic effects (neurotoxicity and neurobehavioral effects), and immunologic effects (allergic sensitization, immunosuppression, autoimmunity). In chapter 5, the NRC report discussed epidemiologic evidence on aplastic anemia, congenital malformations, male fertility, female fertility, pregnancy outcomes (e.g., miscarriage, preterm birth, fetal growth restriction), cardiovascular effects, hepatic effects (e.g., liver function, cirrhosis, hepatic steatosis), gastrointestinal effects, renal effects, systemic rheumatic disease (e.g., scleroderma), amyotrophic lateral sclerosis, Parkinson’s disease, multiple sclerosis, Alzheimer’s disease, neurobehavioral effects, long-term reduction in color discrimination, long-term hearing loss, and long-term reduction in olfactory function.

Dr. Portier's letter questioned the NRC report's use of lowest adverse effect level (LOAEL) values for TCE and PCE. His statement that the NRC did not consider the uncertainties inherent in these values is incorrect. The NRC's report explicitly acknowledged the uncertainties, but 12 of the NRC's 13 committee members nevertheless concluded that LOAEL values provide a useful measure of toxic potency in hazard evaluations. The report presented such hazard evaluations to provide context for the toxicologic evidence, and their limitations were clearly stated, including the statement that they are "not meant to provide a quantitative estimate of risk".

In several places, Dr. Portier's letter seemed to indicate a fundamental misinterpretation of the purpose of the NRC's report, which was to assess the evidence for associations and causal relationships between the contaminants and various adverse health outcomes, not to conduct a risk assessment for regulatory decision making. The preface of the NRC report noted that it is important to understand the difference between the application of scientific evidence in this context and its application in the context of regulatory risk assessment and risk prevention. The NRC committee was asked to examine the statistical associations between past contaminant exposures and each adverse health effect considered, to determine whether a plausible biologic mechanism or other evidence of a causal relationship existed, and to assess the strength of evidence for causal inference. The rules of evidence for assessing past causal associations are different from approaches to regulatory risk assessments, which typically seek to prevent or mitigate potential risk by applying precautionary policies to risk estimates.

Dr. Portier's letter disputed the NRC report's conclusion that groundwater modeling of Tarawa Terrace is unreliable in estimating the exposures experienced by Camp Lejeune residents. His letter stated that ATSDR's "state-of-the-art modeling" shows sufficient concordance between modeled PCE results and actual measurements of PCE. However, the NRC report concluded that ATSDR's complex groundwater models give a false sense of accuracy in estimating past contaminant concentrations in the drinking water. There were only a limited number of contaminant measurements from the 1980s, and the models were calibrated by fitting the modeled predictions to these limited data points, with the assumption that the model would be able to estimate the historical levels in the 1950s, 1960s, and 1970s. Because no measurement data from these earlier decades are available to validate these model predictions, the NRC report concluded that these models were only suitable for conducting a qualitative assessment of long-term exposure.


Dr. Portier's letter cited a 1979 review paper by Dr. Mary Anderson of the University of Wisconsin to support a view that modeling the movement of contaminants in sub-surface water is a well-established area of science. Dr. Anderson, a member of the National Academy of Engineering, was not a member of the committee that authored the 2009 NRC report but was one of its peer reviewers. When asked about Dr. Portier's reference to her 1979 paper, she stated in a letter to NRC staff, "However, the fact that we have been using transport models for a long time does not imply that these models are accurate quantitative tools...the conclusions in my 1979 paper regarding the deficiencies in transport models and the problems in applying them to field situations remain valid today."

Dr. Portier's letter disagreed with the NRC report's conclusion that ATSDR's proposed studies of mortality and cancer incidence have limitations that would preclude them from producing definitive conclusions about what adverse health outcomes can be linked with reasonable certainty to the exposures that occurred. In support of his position, his letter cited ATSDR's 2008 report *An Assessment of the Feasibility of Conducting Future Epidemiological Studies at USMC Base Camp Lejeune*. In fact, ATSDR's 2008 assessment was carefully reviewed in the NRC's 2009 report. The NRC report concluded that ATSDR had not provided convincing evidence that the proposed research would significantly advance understanding of whether the exposures to Camp Lejeune residents did or did not result in measurable health effects. The NRC report recommended that new studies should be undertaken only if their feasibility and promise of providing substantially improved knowledge could be established.

Regarding the question in your April 26 letter as to whether any analyses or conclusions in the NRC's 2009 report need to be changed in response to the ATSDR letter, I can assure you that the NRC stands by its report. No changes are warranted.

Thank you for your interest in the NRC's work. Please let me know if we can be of any further assistance.

Sincerely,

A handwritten signature in black ink, appearing to read "Ralph J. Cicerone". The signature is fluid and cursive, with a large, sweeping initial "R" and a long, trailing flourish at the end.

Ralph J. Cicerone
President